CHAPTER III

MATERIALS AND METHODS

The composition of tree vegetation of five selected forest stands was determined by sampling with point-center-quarter method. On the basis of a study of 20 points in each stand, the importance-value-indices (IVI) of different tree species were determined by summing up the relative values of frequency, density and basal cover of individual species.

Fresh plant biomass of the selected dominant tree species, namely T. grandis, T. tomentosa, A. latifolia, D. melanoxylon, L. coromandelica and B. monosperma was determined in the forest by cutting them with simple hand saw, six inches above the ground level.*

Each tree was identified to be composed of 9 plant parts following Baskerville (1965), Young et al. (1964, 1965) and other workers.

* In the local forests, cutting is permitted at this level for regeneration by coppice growth.
FIG. 2. THE NINE PLANT PARTS OF A TREE

1 TRUNK WOOD
2 TRUNK BARK
3 BRANCHES
4 TWIGS
5 LEAVES
6 MAIN ROOT WOOD
7 MAIN ROOT BARK
8 SECONDARY ROOTS
9 TERTIARY ROOTS
Root system was separated into the following 4 parts:

(1) Main-root-wood,
(2) Main-root-bark,
(3) Secondary roots, and
(4) Tertiary roots.

Shoot system was separated into the following 5 parts:

(1) Trunk-wood,
(2) Trunk-bark,
(3) Branches,
(4) Twigs (branches of current year), and
(5) Leaves.*

The fraction 'bark' included that portion of the stem or root which could be readily removed from the wood portion on drying. Thus, this plant part included the entire tissue beyond the secondary xylem, i.e., cambium, secondary phloem, cortex and cork, etc.

Plant biomass of 20 to 30 trees of each species having different circumference at breast height (i.e., CBH, which was considered arbitrarily related to age) was determined by actual weighings. Originally, it was planned to determine the biomass of a number of trees of a series of different girths and,

* This fragment sometimes included the flowers and fruits also.
therefore, 5 individuals of each CBH, i.e., 15, 30, 60, 90 and 105 cm. were planned to be felled. But, due to a large number of practical and administrative difficulties in felling the trees of an exact CBH, this idea was abandoned. First, the trees were felled and then put in a particular CBH class showing a small range of variation in circumference. Thus, following 5 CBH classes were made which ranged, from 12.5 to 107.0 cm. in CBH.

<table>
<thead>
<tr>
<th>CBH Class</th>
<th>CBH (cm.) Range</th>
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<tbody>
<tr>
<td></td>
<td>From</td>
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<tr>
<td>1</td>
<td>12.0</td>
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<tr>
<td>2</td>
<td>23.0</td>
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<tr>
<td>3</td>
<td>49.0</td>
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<tr>
<td>4</td>
<td>78.0</td>
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<tr>
<td>5</td>
<td>100.0</td>
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</tbody>
</table>

Immediately after felling, the measurements of tree height, CBH, length of clear bole and spread of crown, etc. were recorded. The trunk was cut into 1-2 meter long pieces by hand saw for weighing. In case of straight boles of timber value, measurements of diameter and length were made for estimating its volume, which was later on converted into dry weight. The biomass of the stump left over after felling a tree was also taken into consideration.

Only healthy trees of each species were taken for biomass
studies and hallow damaged or knarred trees were avoided. The felling was also avoided during the period of leaflessness of the trees.

The smaller pieces of trunk were weighed by an ordinary, large-sized double-pan balance or by a spring balance, up to an accuracy of 0.25 Kg. The branches and twigs were cut by an axe and weighed fresh.

For biomass determination, the leaves were hand-plucked by a team of workers immediately after felling of trees. From the heap, 100 leaves were collected in a random way and their green weight was noted down each time. These leaves and 10 cm. thick trunk slices of various girths, from the felled trees were brought to the laboratory in polythene bags for determining moisture percentage.

Smaller subsamples of branches and twigs were also brought to the laboratory. All these samples were dried in the oven at 80°C. By deducting the corresponding moisture content from the green weight of each component, the dry weights of different plant parts were computed.

From the leaf weights and counts, the total number of leaves per tree and average dry weight per leaf were calculated. The area of the sampled leaves was determined by sketching them on graph papers and the average value was used to compute the total photosynthetic area in each tree. Simultaneously, dry
weight and area relationship in leaves was also found out (Table 34).

From the trunk slices, the bark was removed; wood and bark were weighed separately to determine the relationship between girth of stem and percentage dry weight of bark in it (Table 30). Relationship between stem girth and bark dry weight per 100 sq.cm. was also determined.

For determining the dry weights of wood and bark on a unit volume basis, first the volume and dry weight of a subsample of trunk (with intact bark) were determined. Then, after removing the bark from it, dry weight and volume were again determined. The corresponding differences of successive dry weights and volumes of the subsample were the dry weight and volume values of bark. From this data, dry weights of wood, bark and total trunk per cubic meter were calculated.

For determining the total plant biomass on an area basis, a plot of 10 x 10 meter was selected in each forest stand. Clear felling of all trees and shrubs was done and the standing plant biomass and photosynthetic area per hectare were calculated for different vegetational layers, i.e., tree and shrub.

Rate of organic matter production by various plant parts for one centimeter increment in tree CBH was determined by the following formula:
Average biomass difference in trees of adjacent CBH classes (Kg.)

Difference (cm.) in CBH of same classes

Productivity of organic matter in relation to 1 sq.m. photosynthetic area was determined by the following formula:

Average biomass difference in (Kg.) trees of adjacent CBH classes

Average difference in total photosynthetic area (sq.m.) of the trees of same CBH classes

For a study of the horizontal distribution of the roots, a pit of 2 x 21 meter was dug around the tree. The stump remained in the centre of the square. The lateral spread of the secondary and tertiary roots was sketched on a graph paper in the field itself, by making a rope grid on the pit.

These roots were cut and weighed separately. A definite value was assumed each time for those parts which remained undug, and was added to the underground biomass of corresponding trees to get approximate weight of the roots.

A single tree was examined for studying the horizontal distribution of roots in young, medium and mature conditions.
Similar to trunk, relationships of girth with bark percentage and dry weight of bark per unit area, were also determined in case of roots.

**Energetics:**

Smaller subsamples from each of the 9 components comprising the total plant body, i.e., above and underground parts, were taken from the felled trees while studying the plant biomass. These were oven-dried and powdered in an iron mortar and pestle. Small pellets of the powder were formed, dried in an oven on moderate temperature and kept in a desiccator. Caloric values were determined by burning them in an oxygen bomb calorimeter (Educational made, Bombay). These values are based on an analysis of samples in triplicate. The variations were not found to be more than \( \pm 5\% \) in the three tests of a sample.

Following ignition burnt fragments of fuse wire were removed; the crucible, along with ash wash dried each time and weighed. Percentage ash content for each sample was calculated later on.

A weighed quantity of the powder from each sample was also burnt in a weighed crucible in the muffle furnace adjusted at 400-450°C temperature. The ash remaining in the crucible was weighed. The percentage ash content for each plant part
was determined by this method also and the results of these two methods were compared.

The major objects of the study of energy content were:

1. to determine the energy fixed in different components of some selected forest tree species, and
2. conversion of these values to obtain total quantity of energy retained in trees of different (ages) measurements.

The composite samples collected from different forest sites were considered adequate to provide a mean estimate of the standing crop and primary productivity in terms of energy content of the above described species. No measure of site variation was embodied in the plan.